Energy Efficiency
Regulations for Computers manufactured on or after January 1, 2018



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Appliances and Outreach & Education Office

Efficiency Division

WebEx Presentation

October 2017

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- Please use the chat feature to ask questions
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Energy Efficiency
Regulations for Computers
manufactured on or after January 1, 2018

Our webinar will begin at the top of the hour

This slide deck will be posted on
our webpage after the presentation at
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Topic Areas

1. Scope
2. Definitions
3. Test Methods
4. Performance Requirements
5. Reporting Requirements
6. Certification Process

Scope and Definitions

- High expandability computers
- Mobile workstations
- Workstations/Rack-mounted workstations
- Small-scale servers

Definitions

A **computer** is a device that performs logical operations and processes data. At a minimum, it contains these elements:

- A **central processing unit** (CPU) to perform operations or, if no CPU is present, then the device must function as a client gateway to a server and the server acts as a computational CPU;
- The ability to **support user input devices** such as a keyboard, mouse, or touchpad; and
- An **integrated display screen** or the ability to support an **external display screen** to output information.

Definitions

"**High expandability computer**" means a computer with any of the following:

- An expandability score of more than 690; or
- A power supply of 600 watts or greater and either:
  - a **first discrete GPU** with a frame buffer bandwidth of
    - Before 1/1/2020: 400 gigabytes per second (GB/s) or greater
    - On or after 1/1/2020: 600 gigabytes per second (GB/s) or greater

  or

  - an **integrated GPU** and a total of 8 gigabytes or more of system memory with a bandwidth of
    - Before 1/1/2020: 432 gigabytes per second (GB/s) or greater
    - On or after 1/1/2020: 632 gigabytes per second (GB/s) or greater

Definitions

"**Expandability score**" means the results of a calculation designed to estimate a computer's power supply capacity based on the power draw if each interface present in the system were operated at their designed maximum voltage and current.

Definitions

"**Mobile workstation**" means a high-performance, single-user computer primarily used for:

- Graphics
- Computer-aided design (CAD)
- Software development
- Financial applications
- Scientific applications, among other computation intensive tasks, excluding game play

Designed specifically for:

- Portability
- Operation for extended periods of time either with or without a direct connection to an external power source

Definitions

A **mobile workstation** utilizes an integrated display and is capable of operation on an integrated battery and may use an external power supply and have an integrated keyboard and pointing device.

In addition, a mobile workstation **must meet all** of the following criteria:

- Has a mean time between failures (MTBF) of at least 13,000 hours;
- Has qualified or is currently being reviewed for qualification by two or more independent software vendor (ISV) product certifications;
- Supports either:
  - At least one discrete GPU unit with frame buffer bandwidth of 96 gigabytes per second or greater; or
  - A total of 4 gigabytes or more of system memory with a bandwidth of 134 gigabytes per second or greater and an integrated GPU;
- Supports the inclusion of three or more internal storage devices; and
- Supports at least 32 gigabytes of system memory.

Definitions

"**Workstation**" means a computer used for graphics, computer-aided design (CAD), software development, financial, or scientific applications, among other computation intensive tasks. A workstation covered by this specification must meet the following criteria:

(1) Product as shipped does not support altering frequency or voltage beyond the computer processing unit and GPU manufacturers' operating specifications;

(2) Has system hardware that supports error-correcting code (ECC) that detects and corrects errors with dedicated circuitry on and across the CPU, interconnect, and system memory; and (continued)

Definitions - continued

"**Workstation**" A workstation covered by this specification must meet the following criteria:

(3) Meets **two or more** of the following criteria:

(A) Supports one or more discrete GPU or discrete compute accelerators.

(B) Supports four or more lanes of PCI-express, other than discrete GPU, connected to accessory expansion slots or ports where each lane has a bandwidth of 8 gigabits per second (Gb/s) or more.

(C) Provides multi-processor support for two or more physically separate processor packages or sockets. This requirement cannot be met with support for a single multi-core processor.

(D) Has qualified, or is currently being reviewed for qualification, by two or more independent software vendor (ISV) product certifications.

Definitions

"**Rack-mounted workstation**" means a workstation that is designed to be natively rack mounted as described in *IEC 60297-3-101:2004*.

The rack-mounted workstation may be accessed locally by direct connection to the workstation and display or accessed remotely across a network by one or more users.



Definitions

"**Small-scale server**" means a computer that uses desktop components in a desktop form factor but that is designed to be a storage host for other computers.

A small-scale server **has all** the following characteristics:

- Designed in a pedestal, tower, or other form factor similar to those of desktop computers such that all data processing, storage, and network interfacing is contained within one box or product;
- Designed to operate continuously, except for maintenance;
- Capable of operating in a simultaneous multi-user environment serving several users through networked client units; and
- Designed for an industry-accepted operating system for home or low-end server applications (e.g., Windows Home Server, Mac OS X Server, Linux, UNIX, Solaris).

Definitions

Small Volume Manufacturers (SVM)

- Manufacturers with total annual gross revenue of $2 million or less who assemble and sell the computers at the same location and has certified themselves as a small volume manufacturer to the Energy Commission under Title 20 Section 1606(k).
- If a SVM manufactures desktops or workstations in quantities of 50 units or more of a basic model, those units must fully comply.
- Basic models have the same chassis, power supply, motherboard, and expandability score.
- Other computers manufactured by SVMs are exempted from complying with the proposed standards, with the exception of power management.

Definitions

Basic Model

"Basic model" of a computer means a group of computer models that are made by a single manufacturer and that have the same chassis, power supply, motherboard, and expandability score. The chassis shall be considered the same if the energy use characteristics are not modified by variations in the chassis, such as a change in color.

How to Calculate System Memory Bandwidth

System memory bandwidth is included in the criteria for:

High expandability computer…before January 1, 2020 …. a total of **8 GB or more of system memory with a bandwidth of 432 GB/s or more** and an integrated GPU.

" … on and after January 1, 2020 … a total of **8 GB or more of system memory with a bandwidth of 632 GB/s or more** and an integrated GPU…"

Mobile workstation …a total of **4 GB or more of system memory with a bandwidth of 134 GB/s or greater** and an integrated GPU.

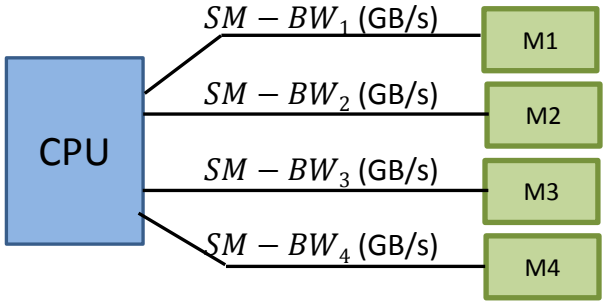
How to Calculate System Memory Bandwidth

System memory bandwidth [GB/s] =

(Memory Data Rate [MHz] * Memory Data Width [bits]) / (8 x 1000)

In cases where there are multiple memory channels, the total system memory bandwidth is the summation of each memory channel bandwidths:

$$Total\ SM-BW = \sum_{i=1}^{N} SM-BW_i$$



How to Determine the Minimum Memory Size Requirement

- High expandability computer:

  " … before January 1, 2020 …. a total of **8 GB or more** of system memory with a bandwidth of **432 GB/s or more** and an integrated GPU…"

- For a system memory with bandwidth of 432 GB/s or higher, if its capacity is 8 GB or more, it meets the requirement and no further calculation is needed.
- In a case of two or more system memories that are connected through separate memory channels, if the summation of the capacities for the system memories each with bandwidth of 432 GB/s or more is 8 GB or more, it meets the requirement and no further calculation is needed.
- In other cases, should be determined as follows:

$$Total\ SM-BW\ \geq 432\ \text{GB/s}$$

$$Capacity_i \geq 8\ GB\ \times \frac{SM-BW_i}{Total\ SM-BW}$$

$where$:

$$Total\ SM-BW = \sum_{i=1}^{N} SM-BW_i$$

Example of System Memory Requirements

For the high expandability computer:

" … on or after January 1, 2018 through December 31, 2019 …. a total of **8 gigabytes or more** of system memory with a bandwidth of **432 GB/s or more** and an integrated GPU…"

Example 1:

M1 : BW =76.8 GB/s, 32 GB
M2: BW = 256 GB/s, 4 GB
M3: BW = 256 GB/s, 4 GB

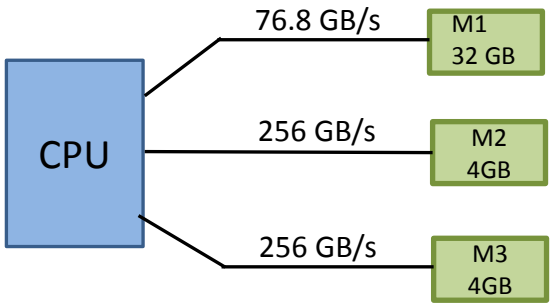
Total SM-BW = 76.8 + 256 + 256 = 588.8 GB/s

C1 ≥ 8 x (76.8/588.8) = 1.04 GB
C2 ≥ 8 x (256/588.8) = 3.48 GB
C3 ≥ 8 x (256/588.8) = 3.48 GB

Test to find out whether the conditions are met:

588.8 GB/s ≥ 432 GB/s **ok**

32 GB ≥ 1.04 GB **ok**
4 GB ≥ 3.48 GB **ok**
4 GB ≥ 3.48 GB **ok**



Meets the criterion?

Yes	No
X	

How to Determine the Minimum Memory Size Requirement

Replace the bandwidth with **134 GB/s** and the minimum size with 4 GB, and apply a similar calculation for **mobile workstation**:

" … a total of **4 GB or more** of system memory with a bandwidth of **134 GB/s or greater** and an integrated GPU…"

Questions?

Test Method for Computers

Test Method for Computers

The test method for computers is the *ENERGY STAR Program Requirements for Computers, Final Test Method (Rev. March-2016)*, with the following modifications:

- Settings regarding hard-disk spinning shall not be altered from the default as-shipped settings.

Test Method for Computers

The total annual energy consumption of a computer shall be calculated using **Equation 1 in Section 3** of the *ENERGY STAR Program Requirements for Computers, Eligibility Criteria Version 6.1 (Rev. March-2016).*

$$E_{TEC} = \frac{8760}{1000} \times (P_{OFF} \times T_{OFF} + P_{SLEEP} \times T_{SLEEP} + P_{LONG\_IDLE} \times T_{LONG\_IDLE} + P_{SHORT\_IDLE} \times T_{SHORT\_IDLE})$$

Where:

- P_{OFF} = *Measured power consumption in Off Mode (W);*
- P_{SLEEP} = *Measured power consumption in Sleep Mode (W);*
- P_{LONG_IDLE} = *Measured power consumption in Long Idle Mode (W);*
- P_{SHORT_IDLE} = *Measured power consumption in Short Idle Mode (W); and*
- T_{OFF}, T_{SLEEP}, T_{LONG_IDLE}, *and* T_{SHORT_IDLE} *are mode weightings as specified in Table 3 (for Desktops, Integrated Desktops, and Thin Clients) or Table 4 (for Notebooks).*

Test Method for Computers (cont'd)

- Computers manufactured **before July 1, 2021**, use "Conventional" or "Full Capability" or "Remote Wake" mode weighting if they meet the criteria.

- Computers manufactured **on or after July 1, 2021**, only use "Conventional" mode weighting.

Test Method for Computers

Workstations shall calculate total annual energy consumption (TEC) using the weighting of Table 8, contained within Section 3 of the *ENERGY STAR Program Requirements for Computers, Eligibility Criteria Version 6.1 (Rev. March-2016).*

Table 8: Mode Weightings for Workstations

T_{OFF}	T_{SLEEP}	$T_{LONG\ IDLE}$	$T_{SHORT\ IDLE}$
35%	10%	15%	40%

Test Method for Computers

The **expandability score calculation** included in test reports is calculated as follows:

1. Identify the score for each individual interface type as determined by Table V-1 and then multiply by the total number of occurrences of that particular interface type present in the system as sold or offered for sale.

2. Sum the subtotals for all interface types.

3. Each instance of an interface may only receive one score.

4. Add 100 to the score.

Table V-1

Interface Types and Scores for Expandability Score Calculation

Interface Type	Interface Score
USB 2.0 or less	5
USB 3.0 or 3.1 Gen 1	10
USB 3.1 Gen 2	15
USB ports or Thunderbolt 3.0 or greater that can provide 100 or more watts of power	100
USB ports or Thunderbolt 3.0 or greater that can provide from 60 or more to less than 100 watts of power	60
USB ports or Thunderbolt 3.0 or greater that can provide from 30 or more to less than 60 watts of power	30
Thunderbolt 3.0 or greater or USB ports that are not otherwise addressed in Table V-1 and that cannot provide 30 or more watts of power	20
Unconnected USB 2.0 motherboard header	10 per header
Unconnected USB 3.0 or 3.1 Gen 1 motherboard header	20 per header
PCI slot other than PCIe x16 (only count mechanical slots)	25
PCIe x16 or higher (only count mechanical slots)	75
Thunderbolt 2.0 or less	20
M.2 (except key M)	10
IDE, SATA, eSATA	15
M.2 key M, SATA express, U.2	25
Integrated liquid cooling	50
Either: 1) CPU and motherboard support for 4 or more channels of system memory and at least 8 GB of installed and compatible system memory; or 2) At least 8 GB of system memory installed on a 256 bit or greater memory interface.	100 30

Test Method for Computers

High expandability computers shall be configured for the test in a manner identical to desktop computers.

Mobile workstations shall be configured for the test in a manner identical to notebook computers.

Test Method for Computers

The **computer sleep mode power measurement** shall be tested in a modified manner from the test procedure described in *IEC 62623:2012*.

Instead of measuring power after manually entering sleep mode, the power measurement shall begin no sooner than 30 minutes and no later than 31 minutes of user inactivity on the unit under test.

This measurement shall be performed after the long-idle test without altering the unit under test.

Test Method for Computers

The power factor of a computer power supply and compliance with the internal power supply requirements shall both be determined by the following test procedure: *Generalized Test Protocol for Calculating the Energy Efficiency of Internal Ac-Dc and Dc-Dc Power Supplies Revision 6.7 (March 1, 2014).*

In addition, the median power factor during short-idle measurements shall be recorded in the test report.

Questions?

Performance Requirements

Performance Requirements

Small-scale servers, high expandability computers, mobile workstations, rack-mounted workstations, and workstations must be manufactured with all of these:

- Either an **80 PLUS®** Gold Internal Power Supply, or a Level VI external power supply
- Energy-Efficient Ethernet
- Power management

Performance Requirements

Small-scale servers, high expandability computers, mobile workstations, workstations, and rack-mounted workstations manufactured on or after January 1, 2018, shall:

- Be powered by an internal power supply that meets or exceeds the standards in Table V-9, or an external power supply that meets the level VI of efficiency described in the *International Efficiency Marking Protocol for External Power Supplies Version 3.0* (Sept. 2013);
- Incorporate Energy-Efficient Ethernet functionality;
- Transition connected displays into sleep mode within 15 minutes of user inactivity; and
- Transition the computer* into either the computer sleep mode or computer off mode measured in Section 1604(v)(5) within 30 minutes of user inactivity. If the transition is to a computer sleep mode, that sleep mode shall either:
    1) Be a computer sleep mode as described in ACPI as S3; or
    2) Consume power less than or equal to the values shown in **Table V-6**.

*Small-scale servers and rack-mounted workstations are not required to comply with Section 1605.3(v)(6)(D).

Performance Requirements

Table V-6
Alternative Computer Sleep Mode Power Limits

Computer Type	Maximum Power Consumption (watts)
Workstations, Mobile Workstations, High Expandability Computers, Small-Scale Servers	**10 + 0.03 * C where C is the system memory capacity in gigabytes minus 32 gigabytes. If C is less than zero, use zero for the value of C.**
Desktop Computers, Thin Clients, Mobile Gaming Systems	5 + 0.03 * C where C is the system memory capacity in gigabytes minus 32 gigabytes. If C is less than zero, use zero for the value of C.
Notebook Computers, Portable All-In-Ones	2.5 + 0.03 * C where C is the system memory capacity in gigabytes minus 16 gigabytes. If C is less than zero, use zero for the value of C. If a discrete GPU is present in the system, the maximum power consumption limit shall be increased by an additional 2 watts.

Performance Requirements

Table V-9

Internal Power Supply Requirements

115V power supplies				
10% load	20% load	50% load	100% load	Power Factor Correction
-	87%	90%	87%	0.9 at 50% load
230V power supplies				
10% load	20% load	50% load	100% load	Power Factor Correction
-	88%	92%	88%	0.9 at 50% load

Performance Requirements

Power Management

- All computers are required to transition displays into sleep mode after 15 minutes or less of user inactivity.
- All computers are required to transition into a sleep mode after 30 minutes or less of user inactivity. This does not apply to small-scale servers, rack-mounted workstations, and computers with no operating system or with only a limited capability operating system.

Effective Dates

Small-Scale Servers and Workstations High expandability Computers, Mobile Workstation	Notebooks	Desktops
January 1, 2018	January 1, 2019	**Tier 1** January 1, 2019

Questions?

Reporting Requirements

Reporting Requirements

Title 20 Section 1606

Products manufactured on or after the effective date must certify their compliance with the standards to the Energy Commission for lawful sale in California, including internet sales.

There are no additional labeling or marking requirements other than the general marking requirements for all appliances that are located in Title 20 section 1607 and that require that the model number, manufacturer or brand name, and the date of manufacture to be permanently and legibly placed on the product.

Reporting Requirements

Modified and Discontinued Appliances

If a manufacturer of a computer fails to obtain two ISV certifications within 60 days of certifying a computer model or loses ISV certifications such that the computer model no longer meets the definition of a workstation or mobile workstation, that manufacturer shall either file to remove the appliance from the database as described in Section 1606(e)(2) or shall modify the model certification as described in Section 1606(e)(1) to comply as a different computer type.

Reporting Requirements

Small Volume Manufacturers

Entities seeking to be designated as a "small volume manufacturer" shall **certify and retain records** to demonstrate the following information:

- Gross revenues from the 12-month period preceding the certification, from all of the entity's operations, including operations of any other person or business entity that controls, is controlled by, or is under common control of the entity, is $2,000,000 or less; and

- The manufacturer assembles and sells the computers at the same location.

If a small volume manufacturer no longer meets any one of the requirements to be a small volume manufacturer, the entity shall file to remove itself from the database as a small volume manufacturer within 90 days.

Questions?

Certification Process

Certification Process

A state- or federally-regulated new appliance sold or offered for sale in California, including via the internet, must be certified to the Energy Commission as compliant with the Title 20 Regulations. This includes:

- Meeting the applicable efficiency standards
- Testing in a test lab approved by the Commission
- Marking each unit per Title 20 §1607
- Certifying each model to the Commission
- Model appears in the Commission's database

Note: Once certified to the Commission, that model is compliant until either a new standard or new test method becomes effective for that appliance.

www.energy.ca.gov/appliances

Title 20 Appliance Efficiency Program

Regulations & Rulemakings

- **Current Appliance Efficiency Regulations**
- Current Appliance Efficiency Rulemakings
- Historical Rulemakings

Outreach & Education

- News, Fact Sheets, FAQs
- Program Bulletins
- Webinar Documents

Featured Links

2016 California Quality LED Lamp Specifications 3.0 (16-AAER-04)

- Appliance Efficiency Regulations For Lamps, Regulatory Advisory

Consumer Cooking Products, Regulatory Advisory

Upcoming Events

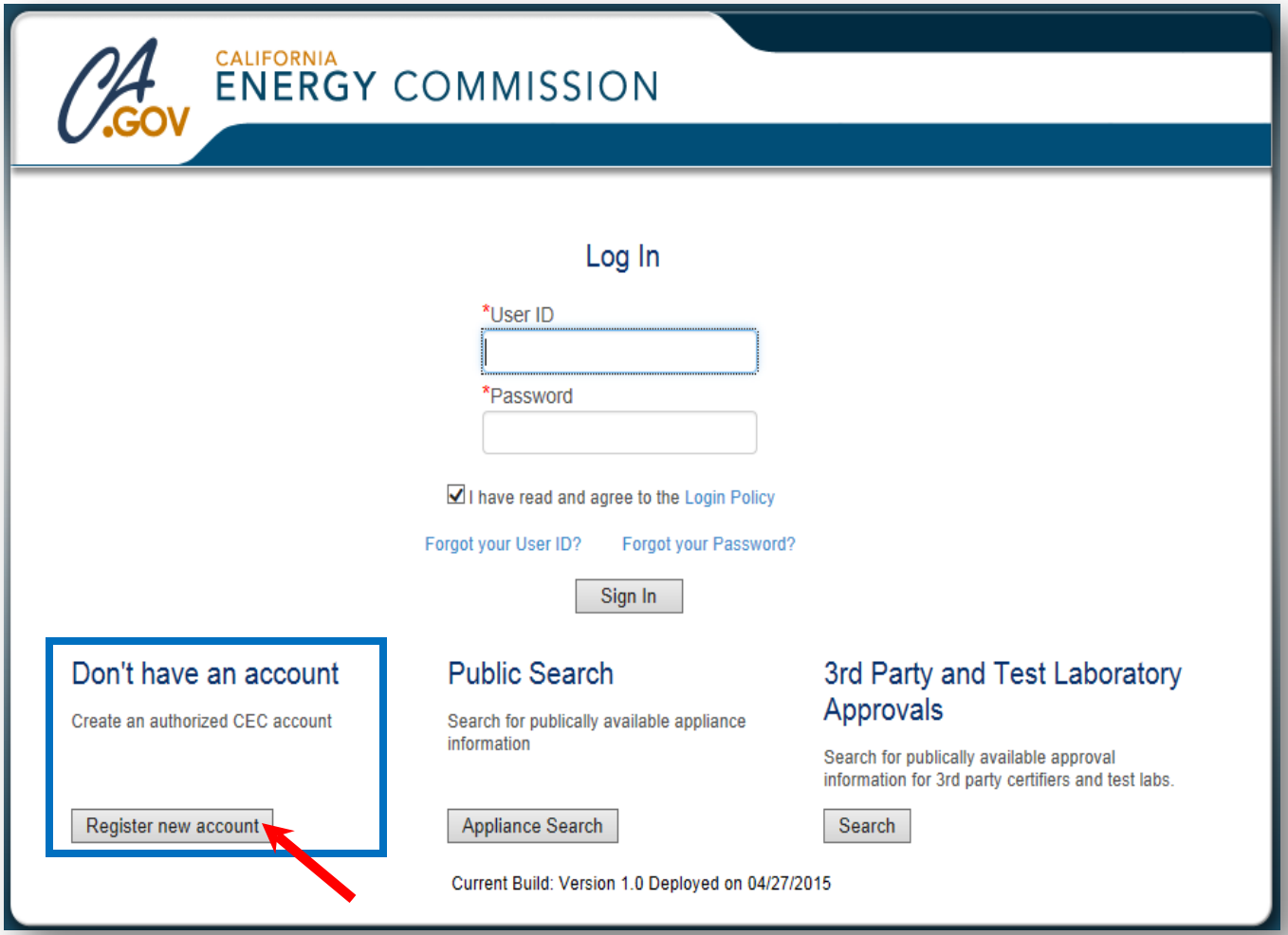
July 19, 2017
Staff Workshop on Responses to Invitation to Participate in the Phase 2 Appliance Efficiency Regulations & Roadmaps: Commercial and Industrial Fans

July 20, 2017
Staff Workshop on Responses to Invitation to Participate in the Phase 2 Appliance Efficiency Regulations & Roadmaps: Spray Sprinkler Bodies, Tub-spout

Modernized Appliance Efficiency Database System (MAEDBS)

- **MAEDBS Log In**
- Quick Search
- Advanced Search
- Company Search (Third Party and Test Labs)
- Certification Packets
- Instructions for Submitting Appliance Data
- MAEDBS Enhancements and Updates

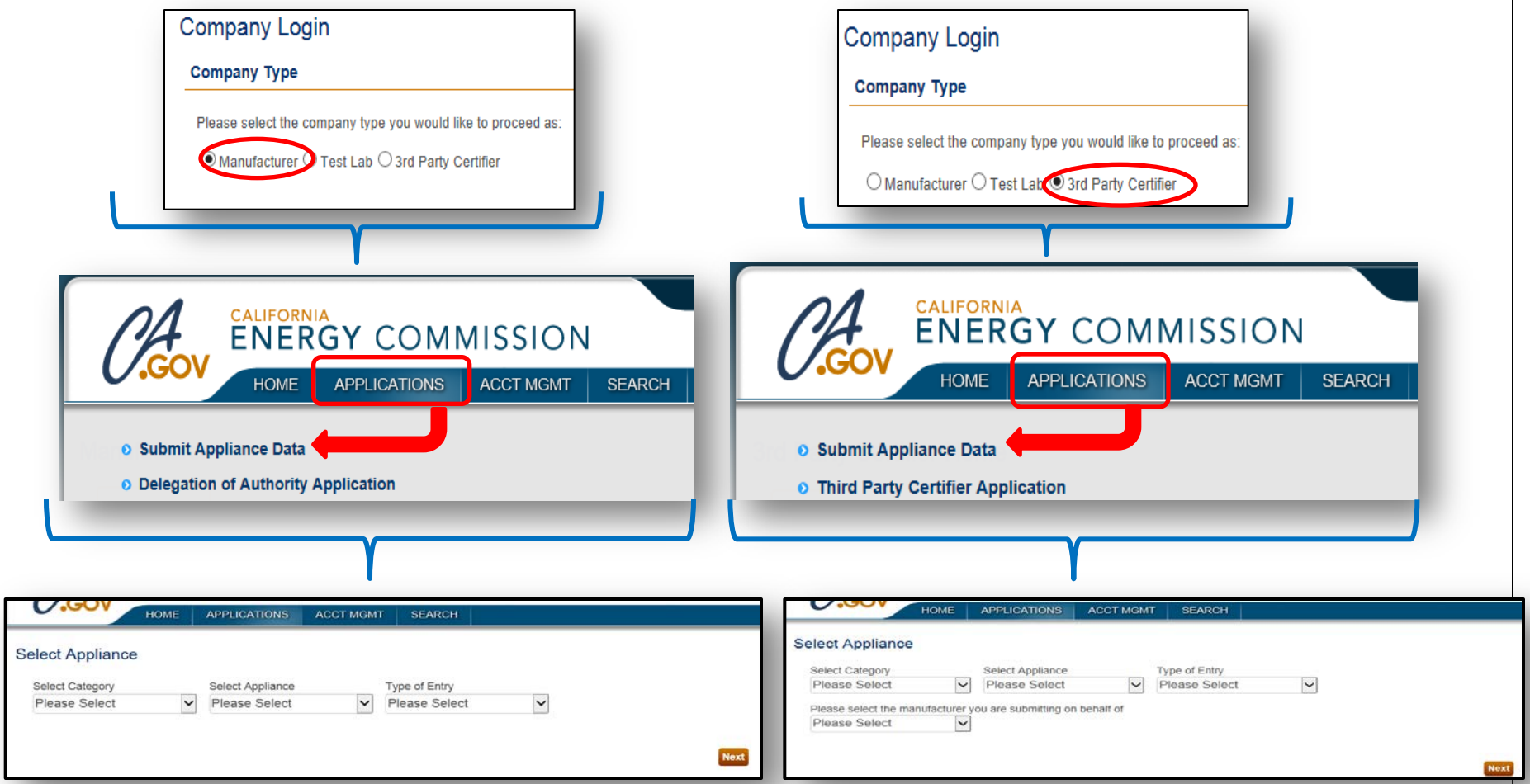
Create New Account



Certification Process

1. Select appliance category and type
2. Choose how to submit appliance data
   - Manually (using computer interface to input)
   - Upload Excel file from your computer
3. Accept and Sign (type) the appliance submittal declaration
4. Submit appliance data for First Stage Validation

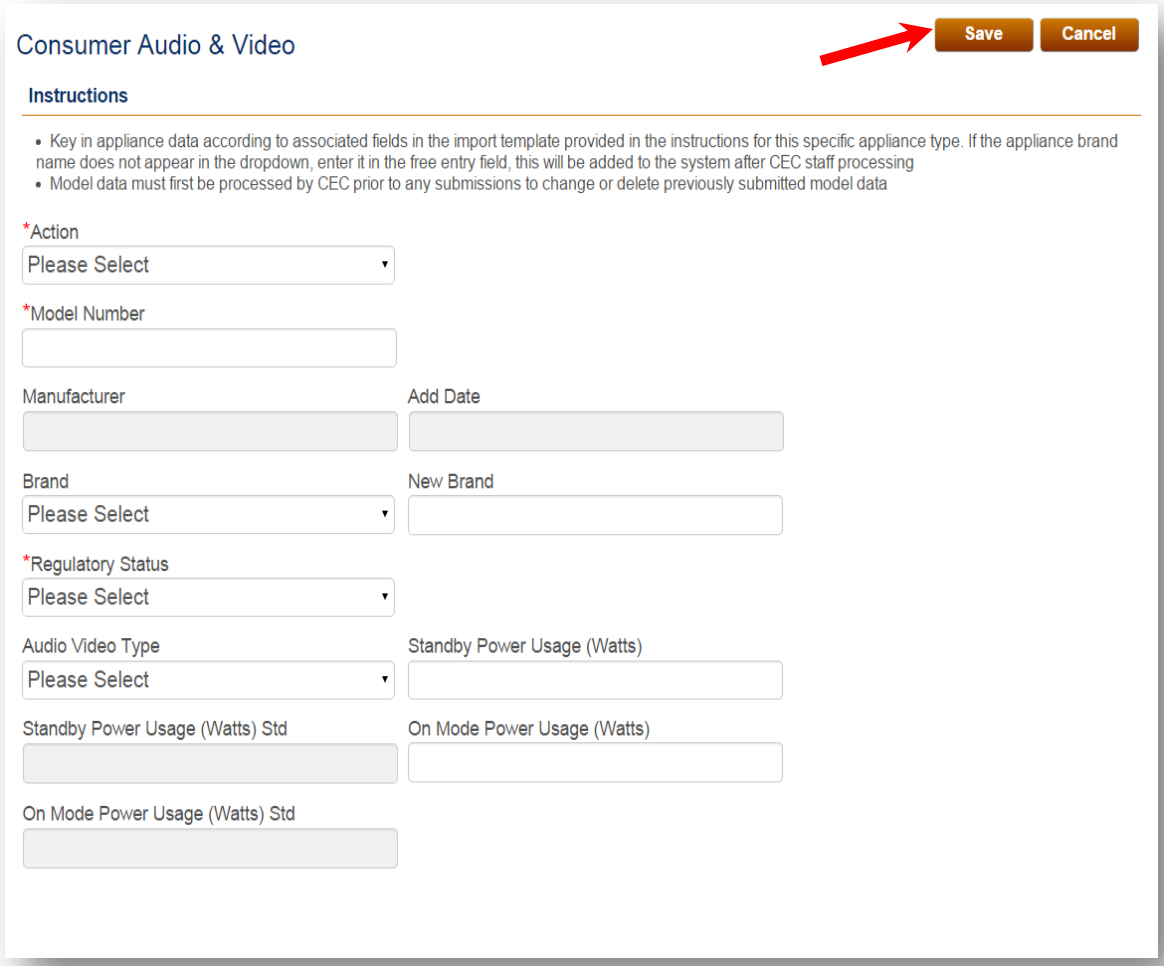
Certification Process



Certification Process

1. Fill out all **fields** .

2. Click **Save** .



Certification Process

Models certified to the modernized appliance efficiency database system (MAEDBS) initially appear in the **Approved** status view.

When a new standard or test procedure for an appliance takes effect, or the model number is deleted by a manufacturer, those certified models will appear in the **Archive** status view. Models marked with a manufacture date before the effective date of a new standard or test procedure remain lawful for sale.

Any model with a manufacture date on or after the effective date must be recertified as compliant to the new standard or certified with data that has been derived from the new test method for lawful sale in California.

Certification Process

Certification Process

- First Stage Validation
  - Submit data through MAEDBS for quality check of the submitted data format
- Second Stage Validation
  - Successful submissions through the MAEDBS First Stage Validation are processed by Energy Commission staff
  - Compliance with federal and state standards is verified

Certification Process

- Second Stage Validation results
  - Successful
    - Appliance data is now available in MAEDBS
  - Partially Successful
    - Unsuccessful data must be re-submitted
  - Unsuccessful
    - Appliance data must be re-submitted
- Results are emailed to the certifier

Certification Process

MAEDBS Enhancements and Updates

The Modernized Appliance Efficiency Database System (MAEDBS) gets updates with new functionality or changes on a regular basis. Details of database enhancements and updates are added to this page as they occur. To receive email announcements of these updates, please subscribe to the Title 20 Compliance Assistance List Serve at the right.

Enhancements

» **April 19, 2017**

MAEDBS Enhancement Update: Permanent Magnet Synchronous Motors (PMSM) Certification.
Permanent Magnet Synchronous Pool Pump Motors may now be certified to the Commission to earn compliance with Title 20. A Fact Sheet on this topic may be accessed at http://energycodeace.com/content/resources-ace/file_type=fact-sheet

» **March 14, 2017**

Metal Halide Luminaires Certification Update.
The metal halide luminaire data submittal template (Lighting Products) has been updated to allow for certification of models that meet the recent federal standards, effective February 10, 2017.

» **January 26, 2017**

New appliance type created to allow for certification to the Voluntary California Quality LED Lamp Specification 3.0.
A new appliance type has been created under the lighting appliance category for State-regulated Light Emitting Diode Lamps. The template and instruction packet on how to certify this appliance type is located under the Data Certification Forms and Instructions for Manufacturers Lighting Products.

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Certification Process

Some common certification errors to avoid

- Read the appliance-specific instructions that are provided in the certification packets – they provide input-by-input instructions for certifying your product(s). Visit **http://www.energy.ca.gov/appliances/database/forms_instructions_cert/**
- Rounding errors: Make sure the efficiency fields are reported properly, you cannot report a higher efficiency than what is tested or calculated. Pay particular attention to the instructions for reporting (decimal places).
- Report the model number as it appears on the unit as what the consumer will see.
- You may not change any of the identifier columns (manufacturer name, brand name, and model number) using the "Change" function. This requires a deletion (action 'D') and resubmission (action 'A' for Add).
- For basic model units that vary only by their color or finish, append an asterisk (*) to the model number to indicate the variation; no other symbol is allowed within a model number unless it is listed on the unit.
  - Do not type out what the variation means in the model number: For example, Model number "**ABCD* (*=1,2, or 3)"** is incorrect. Instead, just enter Model number "**ABCD*"**. Also, as stated in the instructions, a wildcard cannot be used within the first four places of the model number.
- Brand Name issues: N/A, no name, blank, using brand codes, etc. are not allowed.
  - The brand should be the name the unit is marketed under, and what is on the label (for some appliance types the model number will be on the units packaging).
  - Also, please verify if the brand name is in the drop down menu before adding it as "new". Oftentimes the brand name is there. This reduces incorrect spellings of the brand name. For example, Hotwheels (submitted incorrectly) vs. Hot Wheels (correct, and was in the drop down menu).
  - Capitalization does matter, periods after inc.
- Make sure you have checked the correct test method that was used in deriving the test data.

Questions?

Resources

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